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ABSTRACT

This paper is written to familiarize present and future English teachers with the current status of computer assisted instruction (CAI) in the teaching of English. Addressed both to practicing teachers who have little understanding of computers, and English education majors with computer science minors, it deals with programs written in BASIC. The first section is concerned with current attitudes about computers among English teachers, the need for computer literacy, and humanistic concerns regarding computers. The following section focuses on methodology in the teaching of English apart from any form of CAI. The final five sections deal with various aspects of instructional applications of computers which could augment the methods already described. Following each section is a list of suggested projects and activities which vary according to the learner's experience in teaching and/or programming. (Author/CMV)

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Number 19e

The Illinois Series on Educational Application of Computers

COMPUTER APPLICATIONS IN THE TEACHING OF ENGLISH

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To the reader:

This is one of a series of documents prepared as resources for the inservice and preservice training of teachers. The general theme of all items in this series is "teaching with or about computer." The booklets are the collective work of a variety of staff and students (both present and former) of the College of Education, University of Illinois at Urbana-Champaign. The project generously was supported between 1977 and 1979 by a grant from the EXXON Education Foundation. All responsibility for the content of these documents rests with the authors and does not reflect necessarily the views of the EXXON Foundation. It was my extreme pleasure to direct this effort throughout.

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COMPUTER APPLICATIONS IN THE TEACHING OF ENGLISH

Introduction

During the 1970's, the use of computers in secondary and post-secondary education has multiplied dramatically. As a result of improved technology and decreasing costs, computer facilities are becoming available even in small districts. However, despite economic and technical improvements, computers will remain unappealing to most teachers and administrators if they are perceived as having only limited usefulness (i.e., only for administrative record-keeping or only for use by math and business departments). Investment of the school board's money will need to be justified by cost-effectiveness considerations. Certainly, one aspect of these considerations will deal with the question of how many segments of the faculty and student body are able to have access to the computer facilities.

This monograph is written in order to familiarize one segment of the faculty, English teachers, with the current status of computer-assisted instruction in the teaching of English. It is written as a result of pioneer efforts at the University of Illinois, where a project, funded by Exxon Education Foundation, has resulted in the development of an academic minor in Instructional Applications of Computers. (This minor may be elected by Secondary Education majors in any of several academic areas: English, math, science, social studies, etc.) This work is addressed both to practicing teachers--who have teaching experience but little or no understanding of computers--and to undergraduate English Education majors within the IAC minor--who have had some training in computer programming, but no teaching experience. This book especially seeks to encourage the former group by dealing with programs written in BASIC language. It is hoped the work presented here might serve as a bridge, bringing together the classroom savvy of experienced teachers and the programming savvy of teachers-to-be.

As a result of having taken this course, both neophyte and experienced teachers should be able to make informed, intelligent judgments about the value of computer-assisted-instruction in their own schools. They should be familiar with existing programs, their strengths and weaknesses, and should be capable of developing new programs applicable to the needs of their students and adaptable to their schools' facilities. Even for those teachers who might recognize that CAI is not presently appropriate for their schools, the knowledge gained about computer literacy and about "humanistic" concerns regarding computers can be integrated into existing English curricula.

Readers familiar with CAI in schools will recognize that a major limitation of the programs described here that they are interactive and require access to video terminals for the students. At present, most schools are more likely to encourage batch programming, which utilizes keypunch or mark-sensed cards, rather than the interactive programming. Nevertheless, some CRT terminals are available in the schools; they mark a beginning point for this still undeveloped instructional method. Also, perhaps teachers really interested in this field will adapt programs and/or write new programs for English which could be utilized in a batch programming method.

The monograph consists of seven sections. The first "sets the scene" regarding current attitudes about computers among English teachers, and attempts to explain the need for computer literacy. It also deals with the broad view of "humanistic" concerns regarding computers. Section two focuses specifically on methodology in the teaching of English, apart from any computer-assisted-instruction. The final five sections attempt to move from the second and deal with various aspects of instructional applications of computers which could augment the methods described in the second. Following each of the sections three through seven is a list of suggested projects. Activities vary depending upon the reader's experience in teaching and/or programming.

Most programs referred to are written in BASIC because of the availability and ease of use of that language. All students are expected to familiarize themselves with that language as early as possible in the course.

For help in the development of this material, the author is particularly grateful to several faculty and students of the University of Illinois College of Education: Dick Dennis, John Erickson, Bruce Hicks and Jim Hirstein, and Karen, Dixon, Jim Hecht, Lynne Lichtenstein, Vik Muiznieks, Robert Moore, and Jim Stewart.

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I. English Teachers, Humanistic Concerns, And The Need For Computer Literacy

English teachers share with computers at least one common trait--both are frequent victims of stereotyping. How many times have we encountered, in books, plays, or television, any of several "stock" personalities as English teachers: the prim, authoritarian drillmistress whose delight is to "escape" into Romantic poetry; the struggling poet-novelist, who "puts up" with teaching only as a means of keeping food on the table; or the dizzy neophyte teacher whose main concern is to be "relevant" and who shocks parents by assigning the reading of controversial books? The list could fill pages. A similar stereotypical fate has befallen the computer, which often exists in the public eye as one of two images: either the ultra-cute 'droid (ala R2D2 or C3PO of "Star Wars" fame) or the menacing, omnipotent databank. The latter knows everything about you and can wreak havoc when (1) manipulated by any suitably evil genius (cf. the villains in James Bond stories) or (2) allowed to run amok (cf. HAL in 2001). Science fiction abounds with computer "characters" representing both of these extremes, as well as several intermediate stages.

As is true of any stereotype, there are elements of accuracy within these images--but those elements are totally lost as a result of overgeneralizations and oversimplifications. How many readers, for instance, found themselves thinking of Mr. X or Ms. Y (colleagues or former teachers) as they read the descriptions above? Yet we know that neither Mr. X nor Ms. Y fits any of those descriptions perfectly--that other factors (teaching context, age, experience, goals, etc.) contributed to the personality we are recalling. Similarly, the "identity" of the computer is neither benevolent nor malicious. It is simply a piece of hardware, with a great capacity for memory and the ability to manipulate codes within fractions of a second. Thus, because it can store so much data and can manipulate so quickly what is stored, the computer is capable of performing calculations and keeping records much more accurately than a person could (Hence, the associations with billing and other record-keeping tasks). However, the computer's capabilities are meaningless without human interaction. Only people can establish the codes, can impart any meaningful context to them. Only people can decide what manipulations the computer should go through, and only people can put the results of such computation to use, whether for good or ill.

Recently, as the availability of microcomputers for business, home, and school use has increased and as the reports about such computers in popular newspapers and magazines have raised the "awareness" of the general public, these inaccurate stereotyped images of computers have begun to lose credence. The general term for the understanding of computer functions is "computer literacy," and it is promoted by data processing companies themselves, by the media, and by schools.

Data-processing professionals are aware that they may be too easily characterized as "super-heroes" (e.g., for improving speed and ease of airline reservations or of grocery checkout lanes) or as "arch-villains" (e.g., for scandals such as the Equity funding case). They can recognize the value

of having their occupation better understood by the public. Such understanding is promoted both by commercial advertising (e.g., Honeywell's "Someday is Today" campaign) and by the mass media reports which alert people to the potential loss of privacy when huge data banks are owned by either business or government (e.g., the FBI reports on "suspected subversives" or features by "Sixty Minutes" about the ease of establishing a new identity via computer-issued credit cards).

"Computer literacy," a term describing this general understanding of computer functions, advantages, and disadvantages, can also be promoted within the schools. Whether or not computers are used for instructional purposes, students can be introduced to the general nature of computers and the logical processes by which they operate. Just as the general concept of "literacy"--i.e., the ability to read and write--is encouraged by all teachers in all subject areas, so can the concept of "computer literacy" be encouraged by all teachers in all subject areas. Its most immediate applicability, of course, will be in business courses and math courses. However, even we English teachers will have our own unique approaches to computer literacy. We may be able to draw some parallels between the logic necessary for computer programming and the logic necessary for effective communication, for instance. Concerned as we are with "humaneness," we will want to be sure that our students understand not only the utilitarian aspects of computers, but also the implications of computer use for the future of man's communications. Whether or not we would welcome computer-assisted-instruction in English, then, we can recognize our role in the promotion of computer literacy.

A survey conducted by the University of Illinois in 1976 (Dennis, Dillhunt, Muiznieks; 1977) provided statistics about the use of CAI In Illinois high schools. At that time, CAI was being utilized by roughly 35% of the schools. As might be expected, the departments most interested in instructional applications of computers were mathematics, business, and science departments. English departments were utilizing CAI in only about four or five percent of the schools. Interestingly, though, many more English departments indicated an interest in instructional applications of computers. To determine whether or not the statistics in Illinois are representative of statistics nationwide would, of course, require replication studies of a much broader scope. However, assuming that the Illinois figures have even limited validity, the fact that more English departments are interested in CAI than are using CAI serves to underscore the issue that "computer literacy"--an understanding of what computers can and cannot do--is needed, and is needed in English departments as much as in any other department.

What are the general concerns of English teachers? Traditionally, the study of English at the secondary level has had as its foundation the tripod of language, literature, and composition. We encourage our students to understand the history of their language and the system of rules by which it operates (spelling, grammar, punctuation). We introduce them to the excitement reading can present--meeting characters both fictional and real, following those characters through simple or complex plot developments, and considering the impact of setting on the characters and the action. We help them to understand writing as a process, and we patiently advise them through the

pre-writing, writing, and revising stages. In both their reading and their writing, we encourage students to explore values and emotions, as well as to appreciate the relationships among form, content, and style.

We define ourselves as "humanists." Even when we teach "practical" skills of reading and writing, we seek to do so in this context of humaneness, encouraging students to utilize their skills in such a way as to clarify their identities, their relationships to their fellow man. How can the computer--the ultimate symbol of dehmanization--have a role to play in the teaching of English? Clearly, the computer cannot lead discussions. It cannot respond to a student's questions about symbolism in Romantic poetry.

Yet, this is not to say that there are no functions which the computer can serve in the English classroom. In fact, computer-assisted instruction can help to solve one of the most long-lived problems faced by all teachers--individualization of instruction. Its help can be both direct, as it provides individual attention to each student, and indirect, as it frees the teacher from certain mundane teaching chores and facilitates more personal attention to individuals or groups. In basic drill work, such as mastery of spelling or grammar rules, it can provide infinite teaching and testing examples. It can correct students' errors individually, relieving many students from the fear of embarrassing themselves by giving a "wrong" answer in front of their classmates. Through simulations, it can help students to understand the interdependence of character, plot, and setting. As the students manipulate the variables, the computer can suggest alternative resolutions to the story. Text editors (sometimes called word processing systems), programs which allow passages of text to be edited, expanded, shortened, or moved about, may help students through a relatively "painless" process of revising their work (alleviating the typical "Do I have to rewrite the whole thing?" question). Also, test construction via computer can save the teacher's time both in developing and grading examinations.

This document is intended to provide English teachers with an introduction to the various benefits available to them through instructional applications of computers. It is not a technical introduction to computer hardware, nor does it provide instruction in the use of computer programming languages. As has often been noted, a person need not understand auto mechanics in order to drive a car. Similarly, a teacher need not master computer programming in order to be "computer literate," or even to utilize CAI in the classroom. Nevertheless, just as a driver can improve his competence by understanding fundamental principles of engine maintenance, tire maintenance, etc., so can a teacher improve his competence by knowing how to develop or to adapt instructional programming.

In order to complete some of the exercises in this book, then, a teacher will require knowledge of BASIC, a very simple programming language. At the end of this chapter, a few instructional texts about BASIC are identified. Many others exist. Learning BASIC programming will require only a few hours of study; elementary school children have mastered it in a very short time. Those who wish to gain maximum utility from this monograph are encouraged to begin their study of BASIC before going on to section two. Sections three through seven are set up in such a way as to encourage cooperative efforts between teachers and programmers. (Programmers, increasingly, may include some of the teachers' own students.) That is, English teachers need not be

expert programmers, but they do need to understand essential programming principles, so that they can communicate clearly with those who are programming "experts," and so that their suggestions and expectations about programming are realistic.

Projects:

1. If you have not studied BASIC programming language, set aside a few hours in which to learn it. Your first lesson should require only a few minutes of your time. See the list of suggested readings for the names of a few BASIC texts.

2. Begin a journal, keeping track of cartoons, newspaper articles, and book and magazine references to computer--especially to computers in education. Comment on the objectivity, or lack of it.

3. Write a lesson plan for a simple learning objective--one that might require only fifteen or twenty minutes of class time. Identify: (a) the objective of the lesson, (b) potential student responses to teacher's questions, (c) potential teacher responses to students' questions. Could this lesson be "taught" by a computer, in your opinion? Why or why not?

Suggested readings:

I. Instruction in BASIC

Albrecht, Robert L., et. al. Basic. 2nd edition. New York: Wiley, 1978.

Coan, James S. Basic BASIC: An Introduction to Computer Programming in BASIC Language. New York: Hayden Book Company, Inc., 1970.

Peckham, Herbert. Basic: A Hands-On Method. New York: McGraw-Hill, 1978.

Spencer, Donald. BASIC: A Unit for Secondary Schools. Ormond Beach, Florida: Camelot Publishing Company, 1977.

II. Books and articles with "humanistic" concerns

Barth, Rodney J. "An Annotated Bibliography of Readings for the Computer Novice and the English Teacher." English Journal, 68 (January, 1979), 88-92. (See especially the sections "Overview: The Issues" and "Computer Literacy: Concepts and Terms.")

Computers and the Humanities. A journal. Published by-monthly in English, French, German text by Pergamon Press, Inc., Elmsfud, New York.

Educational Technology. September, 1977 issue. This is a monthly journal from Educational Technology Publications, Englewood Cliffs, New Jersey.

Fox, G. Thomas, Jr. and M. Vere Dewault. "Technology and Humanism in the Classroom: Frontiers of Educational Practice." Educational Technology (October, 1979), 7-12.

Montagu, Ashley and Samuel S. Synder. Man and the Computer. Philadelphia: Auerbach Publishers, Inc., 1972.

Muller, Herbert. Children of Frankenstein: A Primer on Modern Technology and Human Values. Bloomington: Indiana University Press, 1970.

Nasman, Leonard O. "Will Technology Revolutionize Education?" Phi Delta Kappan, 60 (December, 1978), 294-296.

Rothman, Stanley and Charles Mossmann. Computers and Society. Second Edition. Chicago: Science Research Associates, 1976.

Suppes, Patrick and Albrecht. "Computer Confrontation: Suppes and Albrecht." Saturday Review of Education, May, 1973, 48.

III. Fiction with "humanistic" concerns

Lewis, Arthur O., Jr. (editor). Of Men and Machines. New York: E. P. Dutton, 1963.

Vonnegut, Kurt, Jr. Player Piano. New York: Delacrte Press, 1971.

II. An Overview Of Teaching Methods In English: How Does CAI Relate?

Section one dealt with the questions English teachers have about computers: How do they function? To what extent are they becoming influential in education? In the world at large? These broad concerns are identified as issues of "computer literacy." As section one suggested, all teachers--whether or not they plan to utilize computers in the classroom--need to encourage students to be aware of both the benefits and the dangers of increasing "computerization" in life.

This second section involves teaching with, rather than about, computers. It deals with such questions as: How can computers contribute to the teaching of English? Can literature, composition, or linguistics actually be presented to students by a computer? If so, what kind of student-computer interaction is possible? In order to answer such questions about methodology, let us first consider the context in which any decisions about teaching method are made: that is, the three-way relationship among content, goals, and methodology.

CONTENT in the traditional English curriculum, as noted in section one, includes language, literature, and composition. GOALS of English instruction cover the spectrum of behaviors and attitudes. If considered in terms of Bloom's taxonomy,[1] they include cognitive and affective objectives ranging from mastery of "basic skills" (e.g., ability to write a "complete" sentence) to the ever-ephemeral "appreciation of literature." METHODOLOGY in teaching English, as in teaching any subject, can vary from individualized instruction to small-group activities to the large-group lecture. For a thorough introduction to the interaction among content, goals and methodology, reader is referred to such texts as Fowler's Teaching Language, Literature, and Composition or Hook's The Teaching of High School English (see "Suggested Reading" at end of chapter). A schematic summary representation of content and methods, though, appears in Figure One (below).

Content

Methods	Language	Literature	Composition
Individual Activities			
Small Group			
Large Group			

FIGURE 1

Specific activities to be listed within the cells of this diagram would be chosen on the basis of a teacher's goals for a particular lesson. For exam-

[1] Bloom, Benjamin S., et. al. Taxonomy of Educational Objectives: Cognitive and Affective Domains. New York: Longman, Inc., 1969.

ple, within the third column (composition), an individual activity (first row) might be "free writing" or journal keeping if a teacher's goal is increased fluency in the student's writing. If the teacher's goal is mastery of a rhetorical model, on the other hand, an individual activity might include imitation of a paragraph or drills on sentence structures. A group activity for that same goal might involve generating a sample paragraph which the teacher writes on the board. Next, consider these examples from the second column (literature). A teacher might schedule a panel report on the historical setting of Macbeth if his goals for small group activity (second row) included familiarity with historical context. Yet, if his goals involve developing students' affective responses, he might ask a few students to stage a particular scene from the play.

As the table indicates, all teaching methods, from individual to large group, can be applied in all content areas. Nevertheless, we tend to identify particular activities as being "typical" for certain methods, contents, or goals. For example, the lecture (a large group activity) is often used to introduce material about linguistic or literary history, or to explain an organizational principle to be applied in writing or reading a paragraph. Small group methods, such as panel discussions, often are used as means of letting students apply what they have learned from their reading or investigating. In composition, small groups of students often act as editors for one another. Individual activities, of course, are the root of all learning. Each student, individually, must read, write about, or discuss the subject matter to gain a mastery of the concepts contained within it. Yet individual activities, with the student receiving personal attention from the teacher, are the most difficult classroom activities to provide. One teacher simply cannot give full attention to one student when a class consists of twenty to thirty students. Though modified versions of "individualized learning" permit students to complete pre-packaged "modules" of material on language, literature, or composition, and to check with the teacher when help is needed, even these approaches do not provide the thoroughness of instruction which both teachers and students desire.

It is in this aspect of methodology--individualized instruction--that the computer can provide the greatest assistance. Because it can provide a wide range of teaching and testing examples, as well as immediate feedback to students' responses, CAI is a major improvement over programmed-text instruction. Also, because the computer has a "memory," it can provide the personalized instruction lacking in programmed texts ("Well, Kathy, you missed that one. Do you wish to review the principle before trying again?"). Clearly, it is no substitute for teacher-student exchanges, but it does multiply "teacher time" available to students in two ways. First, instruction itself is individually presented at a pace each student can follow. Instruction can be repeated as often as necessary for each student without either taxing the teacher's patience or embarrassing the student. Also, because time is not spent repeating instructions, the teacher is available to answer specific questions or to elaborate on issues presented within a lesson.

While individualized instruction is CAI's major strength, the applicability of the computer is not limited to this method. The remainder of section two takes up, in turn, each content area (language, literature, and composition) and illustrates computer applications to that area. In most instances, instruc-

tion described is intended for use by one student working with the computer. Where noted, though, CAI can also become a part of group instruction.

Language

The language aspect of the English curriculum involves study of the history and functioning of English--tracing its Indo-European roots, and the subsequent impact of other languages on those roots to yield our current morphology and syntax, our vocabulary and our grammar. It includes many contemporary concerns about language: semantics, dialects, stylistics, connotation and denotation, etc. The goals a teacher might have regarding this language component of instruction will vary widely, depending upon the experiences and abilities of the students in the class. One goal, for example, may be vocabulary development. Definition of that goal, however, may involve different activities for different students. For some, it may mean identifying root words and affixes which have been borrowed from Latin and Greek. For others, it may mean creating new words to fit the context of various social or scientific concerns of the day (eliminating sexism, for example--or dealing with solar or nuclear-powered energy issues). Another goal may be development of syntactic maturity. For some students, this may involve practice in sentence combining; for others, it simply may mean practice in writing "complete" sentences.

Increasing the number of goals increases the number and type of activities needed to help each individual. An approach to vocabulary development which is successful for Johnny (with the photographic memory) does not necessarily work for Joann (with the analytical mind). The overworked teacher who seeks to "make time" for every Johnny and Joann in class soon realizes the impossibility of the task. It is for combinations such as these that the computer can be such a valuable instructional aid. In a time-sharing system, it can simultaneously be giving Johnny challenging new words while helping Joann realize the patterns predominant in root words, prefixes, suffixes, etc. It can provide both teaching examples and testing examples in countless numbers, can provide personalized feedback to every student simultaneously, and--best of all--can free the teacher to spend more time conferring with individuals, making the sorts of professional observations and encouragements which each learner deserves but which so may seldom get.

Examples of existing programs which are applicable to teaching the language content of the English curriculum include "Cinnamon" by Ellen Nold of Stanford University and a spelling algorithm written by Professor J. R. Dennis, et. al. at the University of Illinois.

Ellen Nold's program deals with the arbitrariness of naming. An excerpt appears here.

> After asking the student to consider some facts about his/her own name, and about our tradition of a woman's changing her name at the time of marriage, the computer asks:
>
> *Why do you suppose the woman is always the one to change her name?*

The student, at this point, is free to offer a one-word response (e.g., "custom") or to type in a long tirade (pro or con) about feminism, ERA, etc. The computer simply responds:

> *Our tradition has it that a woman belongs to her husband. The name change indicates a shift in the power relationship.*

Then, tactfully moving right along, the computer asks:

> *Speaking of tradition, why do you suppose God had Adam and Eve name all of the animals, instead of doing it himself?*

Once again, the student may succinctly reply with one word (e.g., "lazy") or type in a long response about power, or taking issue with the Adam and Eve reference, or even suggesting God did it "herself." However brief or long the reply, the computer again responds with the idea of *power* in the naming process, continues through several more interactions, and ends with a review of the major points of the lesson, especially of the arbitrariness of names.

The spelling algorithm seeks to identify the nature of a student's mispelling: reversal of letters, omission, addition, etc. The following description of the program helps to illustrate this.

> A sizeable portion of the mispellings involve a single letter in the following ways:
>
> 1. one letter is missing (e.g., perenial, mispelling)
> 2. one letter is extra (e.g., throught, potatoe)
> 3. one letter is incorrect (e.g., capible, professer).
>
> Another large portion of the errors will be noted to involve:
>
> 4. transportation of adjacent letters (e.g., dose for does, procede for proceed)
> 5. combinations of 1-3 above (e.g., tommorrow).

Having identified these five types of errors, the spelling program then can be used to classify a student's errors and to suggest remedies for them. This excerpt from Dennis' program helps to clarify:

> With the observations we can build a first approximation to a spelling algorithm and set about determining what level of accuracy our algorithm provides. The following discussion is couched in the context of the BASIC programming language, the most popular one in schools today. For the moment, we shall assume that the computer has a storage location (called T$) for the correct word and another one (called A$) for the possible mispelling. Our initial check is for equality of A$ and T$. Obviously, if A$ is an exact duplicate of T$, then no error of any kind has occurred. If A$ and T$ are not the same, we must determine whether (1) A$ is a mispelling of T$ or (2) A$ and T$ are different words. We proceed to identify as mispelling on the basis of word length (i.e., the number of characters present). For a missing letter, the length of A$ is one less than that of T$. For an extra letter, the length of A$ is one more than that of T$. For an incorrect letter, the lengths are the same, as is the case of an adjacent letter transposition. For our first approximation, we shall (arbitrarily) say that word lengths differing by more than one letter represent different words. (This is not totally correct, but our initial experiment is to determine the reliability obtained by the simplest test.)
>
> For each of the possible errors (missing letter, wrong letter, or extra letter), we compare each letter of T$ to the corresponding letter of A$, starting with the initial letters.

Other programs which would be applicable to the study of language include those on vocabulary development and on figurative language. Group work, if desired, can be developed when students compare the variety of responses they gave to the same program's questions.

Literature

The teaching of literature includes many topics. In some courses, emphasis may be on genre: contrasting poetry with the short story, the novel, and the drama. In other courses, especially historical surveys, emphasis may involve relating the works and the lives of their authors to social and political developments of the period in which the works were written. In courses organized thematically, one particular issue, or theme, may be traced through a variety of works: poetry, short stories, novels--even film or television dramas. In any studies of literature, attention will always turn to essential elements: character, setting, plot and theme (for prose); and rhythm, rhyme, meter, and theme (for poetry).

Again, as was true of teaching literature, individual differences among students often present challenges for the teacher. While one student may be struggling to ascertain "who's who" among the characters or to recall the correct sequence of plot development, another student may be ready to share

insightful comments about the similarity of one character to another, or to relate thematic issues among several works studied. In these studies, too, the computer can help the teacher by providing individualized instruction.

Simulation programs could be used, for example, to permit students to consider various potential resolutions to a plot, based on what is known of the characters or setting at the midpoint of a story or novel. This is a particular example of CAI lending it self to group instruction. Several students might discuss the variety (or similarity) of outcomes, based upon the choices they made for actions to be taken by the characters or changes to be made in the setting. In chronologically structured survey courses, simulations could be particularly effective in helping students to comprehend the historical context in which various works were written.

Regarding poetry, numerous programs exist which are applicable to its study or its creation. "Random word generators," for instance, have been utilized in the program "Bard." This allows students to create poems by indicating words of various syllable-lengths, thyming words, articles, conjunctions and the like. Students can then consider the meaning (if any) or relationships established among words randomly assembled in poetic form. Or, the program also allows students to deliberately structure a poem according to particular meters or rhyme schemes. Another type of program analyzes existing poetry--counting the number of syllables, for instance, or examining rhyme scheme. This type is often used for scholarly analysis, as reported in the jouranl, Computers and the Humanities. With each type of program, work may be limited to the individual's interaction with the lesson, or students may meet in groups with the teacher to discuss the variety of results they have obtained.

Composition

Many readers may have accepted the idea of computer-assisted instruction in the teaching of language and literature, but may be hard-pressed to believe that the computer has a function in the teaching of composition. After all--the student must write a paper and the teacher must read it. Right?

Surprisingly enough, though, the computer can be an effective teaching aid for composition. Through the use of a text editor, a specific utility program, students can do exactly what the name implies--edit their text. As the student types his essay, he also can type in symbols to indicate paragraphing, spacing, etc. Then, when he views his composition--either on a screen or on a paper printout--he sees it "typed" in proper format. If there are any errors or any editorial changes, he can make specific changes without retyping the entire paper. Lines can be rearranged, spelling corrected, new paragraphs begun, etc.

Another type of program helpful to the teaching of composition is one which encourages students to consider the relationship of audience to the content of their work, and to arrange their arguments logically. An example of this type of program is another written by Ellen Nold, "Arrowroot."

The program presents a series of questions to which the student responds.

> *Use two or three words to state the subject of your paper. (Response 1)*
>
> *What is the main point you will make about (Response 1)? (Response 2)*
>
> *Who is your audience? Whom are you trying to persuade or convince? (Response 3)*
>
> *What does (Response 3) already know about (Response 1)?*

This interaction continues, and the student eventually considers the need for new information, the anticipated attitude of the audience, specifies of suport for his/her argument, and the most forceful order in which to present them.

The process here, as in each of the programs, is the same one that any good composition teacher would follow. The point here is not to indicate the existence of NEW teaching procedure, but rather to indicate that the computer is able to imitate good teaching procedure and to make it more readily available to students on an individualized basis.

With these programs, as with those described in the previous sections on language and literature, students can work in groups as well as individually. Students can "proofread" for one another, as well as offer editorial assistance by commenting about word choices, sentence structures, logical fallacies, etc.

Summary

This section has presented an overview of the application of computer-assisted-instruction to the teaching of English. Examples of programs dealing with language, literature, and composition instruction were cited. Several questions remain, however. Primary among these would be one facing the teacher for whom CAI is an available option: "How do I determine when CAI is preferable to other methods of instruction?" There is, of course, no easy answer to the question. The nature of the learners, of the subject matter, of the teacher's goals--these and many other variables influence the decision. Often, a lesson available on a computer may be used in conjunction with other formats--for instance, as a means of reviewing material presented in a class, intended for use by students who were absent or by those who need reinforcement, even after being present for a lecture or a discussion.

Such texts as those cited earlier in this chapter (Fowler and Hooks) can help the teacher or teacher-in-training make decisions about instructional

method. Once a teacher has decided to make material available through CAI, though, s/he must understand and be able to apply essential programming skills. Several other works in this EXXON-sponsored series are particularly helpful for the teacher ready to begin such programming. A Teacher's Introduction to Educational Computing (ISEAC 2e), by J. Richard Dennis, offers definitions and descriptions of the basic types of instructional assistance offered by computers: computer-managed instruction, drill and practice programs, simulations computer-assisted testing, instructional games, tutorials, and problem-solving. (Subsequent chapters of this document will investigate the application of such program types to the teaching of English.) Planning Instruction for Computer Assistance (ISEAC 4e) by Stephen Alessi and J. Richard Dennis summarizes the activities engaged in when planning any lesson (analysis, selection, development, and evaluation), describes the methods of such planning, and then describes the formal planning necessary for instructional aplication of a computer. (After all, the computer--unlike a human teacher--cannot cope with "surprises.") That document takes the teacher step by step through the "flowchart" approach to the planning of instruction. In a third document, The Question Episode--Building Block of Teaching With A Computer (ISEAC 3e), Dr. Dennis defines the "question episode" and explains the significance of each of its five elements in the structuring of a good instructional program. Anyone who as yet has not read these three documents should do so before proceeding to section three. Those who have read them may wish to quickly review their contents.

Sections three through seven consider the applicability of particular types of programs to the teaching of English, including the use of computers to evaluate writing. Section eight deals with "building in feedback," so that teachers can have a consistent method of evaluating software and hardware, as well as students' performance.

Projects:

1. Make a list of some of your own goals in the teaching of language, of literature, and of composition. Choose any ONE of those goals and answer the following questions about it. What materials might you and students use? What activities will help students achieve that goal? How will you evaluate students' achievement of that goal?

2. Establish a formal (flowchart) approach for a lesson relevant to the goal you dealt with in answering the questions above.

3. If you have access to any CAI programs intended for use in teaching English, go through one of them. Pur yourself in the students' place. Give a few incorrect answers to see how the program handles erroneous responses. Take notes as you go through the program. What do you find helpful? frustrating? What changes might you suggest to the author of the program? What aspects do you want to keep in mind--whether for the sake of imitation or of avoidance--for any programs you might write?

4. Read anything from category III (below). Write a 250-500 word critique.

Suggested Readings:

I. Methods Texts re: the Teaching of English

Fowler, Mary Elizabeth. Teaching Language, Literature, and Composition. New York: McGraw-Hill Book Company, 1975. This is one of several "methods" texts for the teaching of secondary English.

Hook, J. N. The Teaching of High School English. This is another "methods" text--probably the most well known.

II. Texts re: Instructional Applications of Computers

Alessi, Steve and J. Richard Dennis. Planning Instruction for Computer Assistance. (Part of this series.) Step-by-step instruction in the "flowchart" method of lesson planning.

Dennis, J. Richard. The Question Episode--Building Block of Teaching With A Computer. (Also part of this serious.) An explanation of the five elements of structuring a good instructional program.

_____. A Teacher's Introduction To Educational Computing. (Also part of this series.) A descriptive introduction to the types of educational assistance offered by computers.

III. Books and Articles re: CAI in English

Ahl, David H. "Computers in Language Arts" in Computers in Education. Edited by O. Lecarme and R. Lewis, 1975. Pages 693-698. Ahl examines various applications of the computer in language arts (drill and practice, data analysis, "open-ended" interactions) and offers some guidance about their use. Bibliography contains potentially helpful resources.

CERL Community College English Staff. Community College English Lesson Index. Urbana: University of Illinois, 1976. Describes nearly 100 lessons available on PLATO in capitalization, composition, editing, grammar, poetry, punctuation, research, spelling usage, vocabulary and language arts games.

Crider, Linda S. "Computer Assisted Instruction (CAI) and the Teaching of English." (unpublished) In this paper

written for a secondary education class at the University of Illinois, Ms. Crider presents a history of CAI and considers particular applications of CAI to the teaching of English.

Dieterich, Daniel J. "The Magical, Mystical, Mechanical Schoolmaster, or, The Computer in the English Classroom." English Journal, 61, n. 9 (December, 1972), 1388-1395. Dieterich discusses English teachers' opposition to CAI, and reviews several ERIC documents in an effort to help teachers who are trying to decide whether their stance is "pro" and "con."

Farrell, Edmund J. English, Education, and the Electronic Revolution. Urbana: National Council of Teachers of English, 1967. Because of such rapid developments in computer technology, much of what Farrell discusses in future tense in already past. This book presents a thoughtful treatment, though, of the role electronics can play in English classes.

Goldberg, Maxwell. Cybernation, Systems, and the Teaching of English. Urbana: National Council of Teachers of English, 1972. Subtitled The Dilemma of Control, this book attempts to put the whole issue of technology and system approaches into focus, reminding us to consider "Who controls the system?"

Handler, Kenneth. "The Computer Comes to the English Classroom: Computerized Monitoring of Pupil Progress in Reading." Educational Technology (November, 1975), pp. 34-35. He describes a system (NOT instructional) which provides diagnostic tests, evaluation, and prescription for instruction. This was used with junior high school English classes, but could be applicable in high schools, too.

Jaycox, Kathy. "Ware, On Ware, Might An English Class Go?" Illinois English Bulletin, Winter, 1979, pp. 21-27. This is an introductory overview of the instructional applications of computers in English.

Maloney, Henry B. New English, New Imperatives. Urbana: National Council of Teachers of English, 1971. The chapter by Edward Simpkins, "Education and the Fourth Reform," is of special interest. He helps to put the use of technology into perspective, encouraging it as part of an overall development of flexibility.

Miller, LaVerne W. "The Humanist and Computer Assisted Instruction--Or Until the Lightning Struck," Educational Technology, 12, n. 12 (December, 1972), pp. 52-58. After discussing her experiences in seeking to imple-

ment CAI in the English department at her institution, Ms. Miller notes several points future CAI users must consider. Most important is to remember that CAI is a MEANS, not an end. Teachers should consider what it can do for students, to help accomplish the goals of the course.

Nix, Don H. "Project Straight-Talk: A CAI Approach to Teaching Standard English As A Second Language." Computers in Education, edited by O. Lecarme and R. Lewis, North Holland Publishing Company, 1975. This CAI system is intended to teach elementary school children that "suitability" or dialect varies with situations, and gives syntax practice with both "straight talk" and "everyday talk."

Nold, Ellen. "Fear and Trembling: The Humanist Approaches the Computer." College Composition and Communications, XXVI, 3 (October, 1975), pp. 269-273. If you read nothing else, read this. Ellen Nold is a pioneer in the development of programs applicable to many aspects of English teaching. She offers several examples here.

Obertino, Priscilla. "The PLATO Reading Project: An Overview." Educational Technology (February, 1974). First in a series of articles dealing with the PLATO reading project at the University of Illinois, this article presents the project's goals, describes the PLATO equipment, explains some basic assumptions made by the project staff, and analyzes some of the initial student experiences with the project.

Rayapati, J. P. R. "Switched-On English: Introduction In Dialectical Switching." Computers in Education edited by O. Lecarme and R. Lewis. North Holland Publishing Company, 1975. The author explains the need to include tutorial lessons in drill programs, so that a student can learn why a "wrong" answer is wrong.

Slotnick, Henry. An Examination of the Computer Grading of Essays. Dissertation, University of Illinois at Urbana-Champaign, 1971. In this dissertation, Slotnick presents the computer as a means of overcoming the problem of interrater reliability in the grading of essays. He worked from the assumption that certain aspects of good writing involve patterns which can be recognized by the computer (in words, sentences, and paragraphs).

Taylor, Robert P. "Computerless Computing for Young Children or What To Do Till the Computer Comes." Computers in Education, edited by O. Lecarme and R. Lewis. North Holland Publishing Company, 1975.

Though he is talking about teaching young children, the methodologies he discusses are applicable to teaching communication skills at all levels. Good for indicating the basic parallels between computer programming and all communication forms.

Also see numerous titles available through the ERIC (Educational Resources Information Center) system.

III. Drill And Practice Programs For Use In English Classes

When most teachers think of computer-assisted instruction, the type of program likely to come to mind is the drill and practice. This is because such programs are among the easiest to write and thus, were prevalent in the earliest courseware produced. Such programs allow students to increase their familiarity with concepts previously explained to them--whether such explanation has come from teacher, text, or another computer program. Identifying word groups as either sentences or fragments is one example of such an activity. Another example might be recognizing the meanings of vocabulary words or composing compound or complex sentences. Such programs operate on the principle of learning by repetition. Their value lies in their interactive nature. That is, each student responds to each question, thus providing a way for the individual to test his own understanding of the material (and relieving the teacher of nerve-taxing oral or written drills).

Such instruction is of the same type presented in "programmed learning" texts, which have been around years longer than computers. The "programmed text" type drills have, in general, been negatively received by English teachers and their students, who see such rigid instruction as contradictory to the "humanistic" spirit of the English classroom. There is a very significant difference between such texts and computer-presented drills, however. In the text drill format, the student is presented with a question, answers the question, and then checks his answer. If it is correct, he proceeds to the next frame (question). If it is incorrect, he is expected to repeat his study of the material in an effort to clarify whatever misunderstanding he has. Two of the most obvious flaws in this drill format are: (1) it depends upon the student's own motivation to review misunderstood material; and (2) it offers no alternative explanation for misunderstood material. That is, if a student answers a question incorrectly, the text offers only repetition of the misunderstood material, rather than a new approach to it.

By contrast, drill and practice programs presented by computers need not have such limitations. If a student gives an incorrect answer, the program can automatically present material to review. If the author of the program has been careful, the student can be offered alternative explanations, which should enhance the likelihood of the student's gaining a mastery of the concept.

In another document in this series, Drill and Practice on a Computer (ISEAC 7e), James Stewart has presented a thorough explanation of the nature of drill and practice programs. A summary of his directives for designing D & P programs appears below.

SUMMARY

When designing a computerized drill and practice lesson, the following considerations should apply:

1. Select the content and processes of the lesson to match the content and processes of the initial instruction.

2. Present a variety of stimulus presentations for an item.

3. Select constructed or non-constructed response modes by the type and complexity of the material being practiced.

4. Provide appropriate feedback for a student's response. In the case of an incorrect response, the corrective feedback should match the error. In the case of a correct response, social evaluative statements should be varied to avoid redundancy.

5. Systematically select the next appropriate item to be presented. Recycle initially correct items to demonstrate that knowledge is actually present. Recycle initially incorrect items more frequently and earlier than correct items to give additional and more immediate practice.

6. Have some appropriate lesson termination strategy.

7. Update records and report the student's score in some meaningful manner.

By following such considerations, the author of a drill and practice program will provide several advantages over "programmed text" instruction. In addition to achieving the two benefits noted earlier ("automatic" review and alternative explanations of concepts), the program author can: (1) match the content and the method of presentation to that used by the classroom teacher; (2) allow either "constructed" or "non-constructed" responses (i.e., those in which the student's answer must be created or those in which the answer is selected; (3) provide a variety of feedback comments to students--when their responses are right as well as when they are wrong; (4) provide "recycling" of questions, to guarantee that the student really understands and didn't simply make a lucky guess, and (5) incorporate a record-keeping format, to keep track of answers attempted as well as answers achieved. Within that publication, Jim Stewart also provides an example of a general drill and practice system for quickly implementing such activities.

How might such programs be applied to instruction in English? As noted earlier, their use would involve lessons in which the objective is the students' mastery of a particular skill or memorization of terms. If increasing

of vocabulary is important (for example, in preparing students for college entrance exams or preliminary to the reading of a novel in which unfamiliar words will appear), programs can be written which allow students to define the words, or to match them with synonyms or antonyms, or to fill in the blank of a given sentence with the appropriate word from a list. If mastery of a temporal or spatial concept is important to students' understanding of a particular literary work, a program could present lists of the concepts, asking the students to arrange them in the order in which they occurred in that work. Similarly, in a survey course organized chronologically, students might be required to arrange works studied in chronological order, or to match them with the appropriate description of a historical period. In basic or remedial writing courses, students ofter are required to master grammatical concepts. Drill and practice programs might require students to identify subjects and verbs, to construct particular types of sentences (declaratory, interrogative), or to combine sentences.

For each of these learning objectives, computer programs can be (or have been) written. A sample excerpt is included in the following pages. In evaluating these programs, or in evaluating programs which you or other members of your faculty might write, always keep these criteria in mind:

1. Is the objective of the lesson worth the investment of the programmer's time in writing it and of the students' time in using it? That is, is it an important goal for students?

2. What is the average length of time involved for a student to complete the program? (Research indicates that students become tired after 30-45 minutes of drill; learning may be significantly reduced if the lesson requires more time than that to complete.)

3. What are the criteria for completion of the lesson? Must the student simply answer every question, or must he answer a certain percentage correctly? If the latter is true, does that percentage change if he has missed particular questions? (i.e., two correct for every one wrong, for example)

4. If the student answers incorrectly, is he offered some explanation before the question is presented for a second time? Does it approach the concept differently from the way it was first approached?

5. What record-keeping function is built into the program to keep track of attempts made and successes achieved? Is this "feedback" presented to the student?

6. What importance--if any--does time have? Must the student answer within a limited time? Is the time factor appropriate for the learning objectives?

7. If the student must leave the program at any point before completion (class time ends, the computer breaks down, there is a fire drill, etc.), can he pick up at the point of interruption, or must he begin again at question one?

8. Does the tone of the lesson (personalization, humor) contribute to its effectiveness? Why or why not?

Below is an excerpt from the program "Venus," written by Lynne Lichtenstein. Lynne, an experienced English teacher and teacher trainer, wrote this program while enrolled as a graduate student at the University of Illinois. (This was produced after only a few weeks of familiarity with BASIC programming.) The program introduces definitions of four parts of speech: noun, verb, adjective, adverb. Then, presenting sentences which contain nonsense words, the program asks students to identify the part of speech each nonsense word should be.

```
PRACTICE YOUR UNDERSTANDING OF STRUCTURE WITH THE
FOLLOWING SENTENCES.  SOME OF THE WORDS MAY BE
UNFAMILIAR TO YOU, BUT THE ENGLISH STRUCTURE IS
FAMILIAR.  AFTER YOU TYPE IN AN ANSWER PLEASE
HIT THE RETURN KEY.


THE OOGLE JUMPED OVER THE FENCE.

WHAT DO YOU THINK AN OOGLE IS?
? DOG
THAT'S INTERESTING.
WHAT KIND OF WORD IS IT?  TYPE IN
ONE WORD THAT WILL ANSWER THE QUESTION
SUCH AS - NOUN, VERB, ADJECTIVE,
OR ADVERB.
? ADJECTIVE
NO.  TRY AGAIN.
WHAT KIND OF WORD IS IT?  TYPE IN
ONE WORD THAT WILL ANSWER THE QUESTION
SUCH AS - NOUN, VERB, ADJECTIVE,
OR ADVERB.
? NOUN
CORRECT, LYNNE.
OOGLE IS A NOUN.

REWRITE YOUR  SENTENCE PUTTING IN THE ENGLISH
WORD FOR OOGLE.
? THE DOG JUMPED OVER THE FENCE.
```

Projects:

I. For Everyone

1. Identify several objectives of English instruction which might be achieved through a computerized drill and practice program.

2. What are the advantages of computerized D & P lessons?

3. What are the disadvantages of such lessons?

4. If you have not already done so, prepare a practice question-answer set which can be implemented in the DAP1 program format contained within ISEAC 7e in this series, Drill and Practice on a Computer by James T. Stewart.

II. For Teachers With Little or No Computer Experience

1. Identify two or three lessons within a teaching unit which could be developed using computerized D & P programs.

2. Work with a programmer to implement one of your programs.

III. For Experienced Programmers

Take an existing D & P lesson which you think has flaws (not enough feedback to students, not enough options, etc.) and try to improve it.

Suggested Readings:

Byerly, Gayle. "Generating English Programs at a Small College." (Paper presented at 1978 CCUC.) Ms. Byerly describes several programs she implemented. They include "Chrono," which requires that students arrange a scrambled list of novels in chronological order; "English," a short-answer program; "Match," for matching quotations with their sources; and two other programs which are spelling and punctuation drills.

Miller, Harry G. and Kevin Swick. "Appropriate Uses of Drill Exercises." Educational Technology, XVI (October, 1976), pp. 26-30.

Stewart, James T. Drill and Practice on a Computer. (ISEAC 7e in this series) Mr. Stewart describes the qualities desirable in a D & P program and offers a "universal" program in which questions and answers on any subject may be used.

IV. Tutorial Programs And Simulations In English Classes

As noted in the previous section, the drill and practice programs prevalent among earliest produced courseware did not provide the type of instruction most desired by English teachers. Such programs deal with the basic cognitive functions--recognition and memorization--but not with the higher thinking processes of analysis and synthesis. Still, drill and practice programs do have applicability within the study of English, as that section pointed out, because students must master certain basic skills which involve memorization. However, if drill and practice programs were the only type of CAI available, most English teachers would feel the applicability of CAI to be too limited to make the investment of time and money worthwhile. Such is not the case, however. Several other types of instructional programs exist, and they are well-suited for use in English classes. Two of these types--tutorial and simulation programs--are the subjects for this section.

Tutorial

The nature of tutorial programs is evident from the name. Drill and practice programs were characterized in the preceding chapter as allowing students to increase their familiarity with concepts previously explained to them. Tutorial programs, unlike D & P, include the presentations and explanations. Richard Dennis, in Tutorial Instruction on a Computer (ISEAC 6e), compares tutorial programs to an idealized teacher-student interaction in which the basic elements "consist of an array of question episodes" (p. 1). He goes on to point out that "the functioning of the computer program is dominated by the methods of treating the unexpected responses" (p. 1).

Thus, in a typical tutorial program, a student will encounter several lines of text, in which particular information is presented to him. He will thenencounter one or more questions based upon that information. The challenge to the author of such a program lies in anticipating the various answers a student might give to questions presented. When a teacher asks a question in class and a student responds, the teacher has the immediate opportunity to judge the student's answer. It may be correct or incorrect. However, if it is incorrect, the error may have any of several causes. Was it simply due to the student's failure to pay attention? Or was the material too difficult for the student to comprehend? Or is it possible that the student understands the material and simply misunderstood the questions because of its wording? Still another possibility is that the student might give a conceptually correct answer which is literally incorrect. When any of these events happen during an actual teacher-student exchange, the teacher can use the student's response as an index by which to determine the approach subsequent questions should take. (Should there be additional instruction? Should the question simply be re-worded? Should the student be chided into alertness, or is it really time to abandon the lesson for a total change of pace?) Computer-assisted instruction lacks the total flexibility of such actual teacher-student interaction, but well-written tutorial programs can approximate this flexibility. The key lies in the thoroughness with which the programmer anticipates various student responses.

Consider these examples of programs written by Ellen Nold and her associates at Stanford University. (The programs were originally written in PILOT and were "translated" into BASIC by students at the University of Illinois.) The programs represent varying degrees of sophistication in their reactions to student responses.

"Cinnamon" has as its objective helping the students to realize the arbitrariness and the power of language. In section two of this document, a passage from that program was presented (about why women change their names at marriage). Representing a most elementary level of interaction, this program continues to present text and ask questions regardless of the student's responses. That is, while the program allows student input at appropriate intervals, no subsequent line of the program uses that input in the formulation of additional questions or statements.

Two other programs written by Ellen Nold are more sophisticated in their incorporation of a student's responses. "Sage" is a program dealing with the creation of poetry.

> In this program, the student is asked:
> *You just touched the computer. How does it feel?*
>
> When the student responds, the computer replies:
> *Fine. Now say it again in a different way. It feels like . . .*
>
> Again, the student completes the statement. This time, the computer's response is:
> *Good. Even more far out? It feels as if . . .*
>
> When the student completes that line, she/he is informed:
> *You've just written a poem ("Terminal?". Here it is.*
>
> Then the student's three responses appear:
> *(Response 1)*
> *Like (Response 2)*
> *Just as if (Reponse 3)*
>
> The program then goes on to allow revision of the poem and to encourage the student to deal with abstract words (e.g., "desperation") with similar figurative usages, to make connections between the abstract and the concrete.

Note that in this program the student's responses <u>are</u> incorporated into the development of the concepts of figurative language and of poetry. Still, the program includes no judgment of students' responses. That is, if a student were to type in "cold" for each of the three times his input was requested, the poem would simply read:

Cold
Like Cold
Just as if Cold

Any evaluation of the student's responses thus depends upon his or her teacher's reaction to the finished product. This same degree of sophistication--incorporation of a student's responses without evaluation of them--characterizes the program "Arrowroot" (also described earlier), which presents a series of questions intended to help students organize an argumentative or an expository theme. With this program, as with "Sage," any evaluation of a student's responses must still involve interaction with the teacher.

As one might guess, little has been done with the most sophisticated type of tutorial program--that which judges the adequacy of a student's responses and channels him toward either easier or more challenging instruction. None of the programs cited here incorporate that idealized capability of evaluating a student's answers and directing him to the appropriate work. A flowchart description of the logic necessary for such a program, however, is contained in ISEAC 6e, Tutorial Instruction on a Computer (Figures one, two, and three). Taking some time to review those three figures will help the reader to understand the complexity of such programming. An example of such instruction applicable in the English classroom might involve teaching the concept of "metaphor." Is the student confusing metaphor with simile? Or is he confusing it with literal comparison? Can he recognize metaphor but not produce it? vice-versa? Obviously, the type of instruction needed will vary, depending upon the nature of the student's misconceptions.

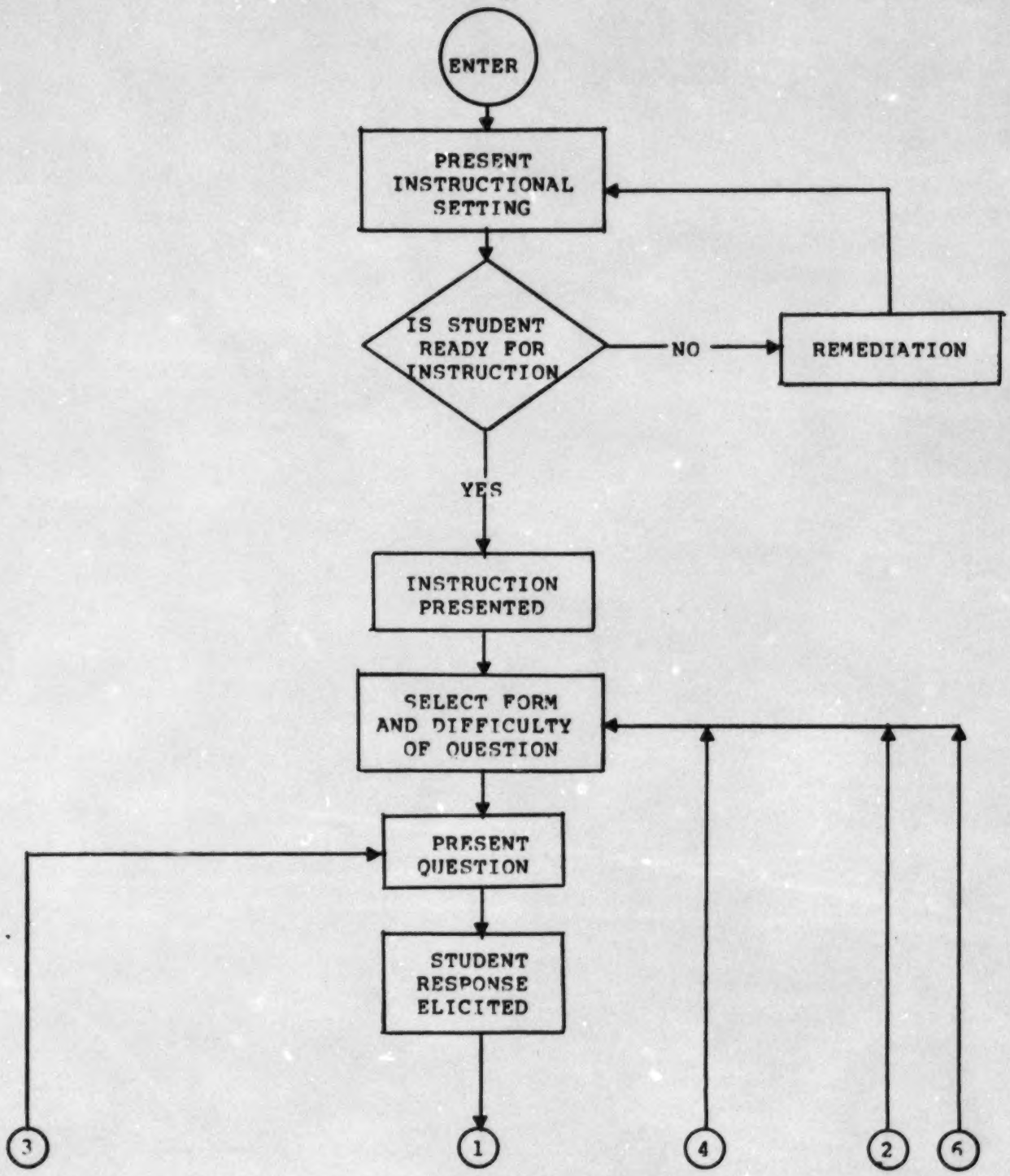

FIGURE 1
Evaluation of Readiness and Presentation of Instruction

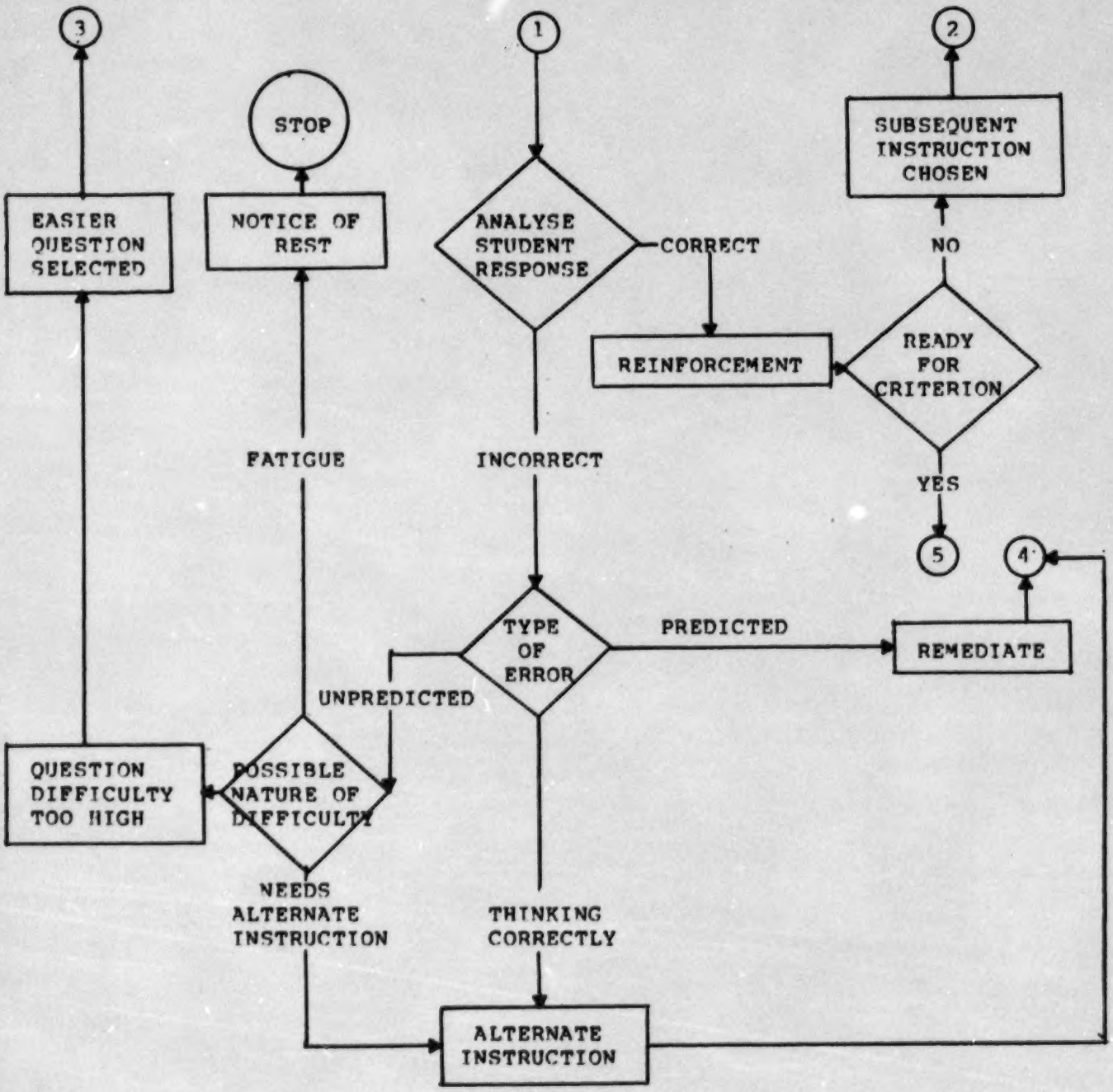

FIGURE 2
Evaluation of Response and Appropriate Action

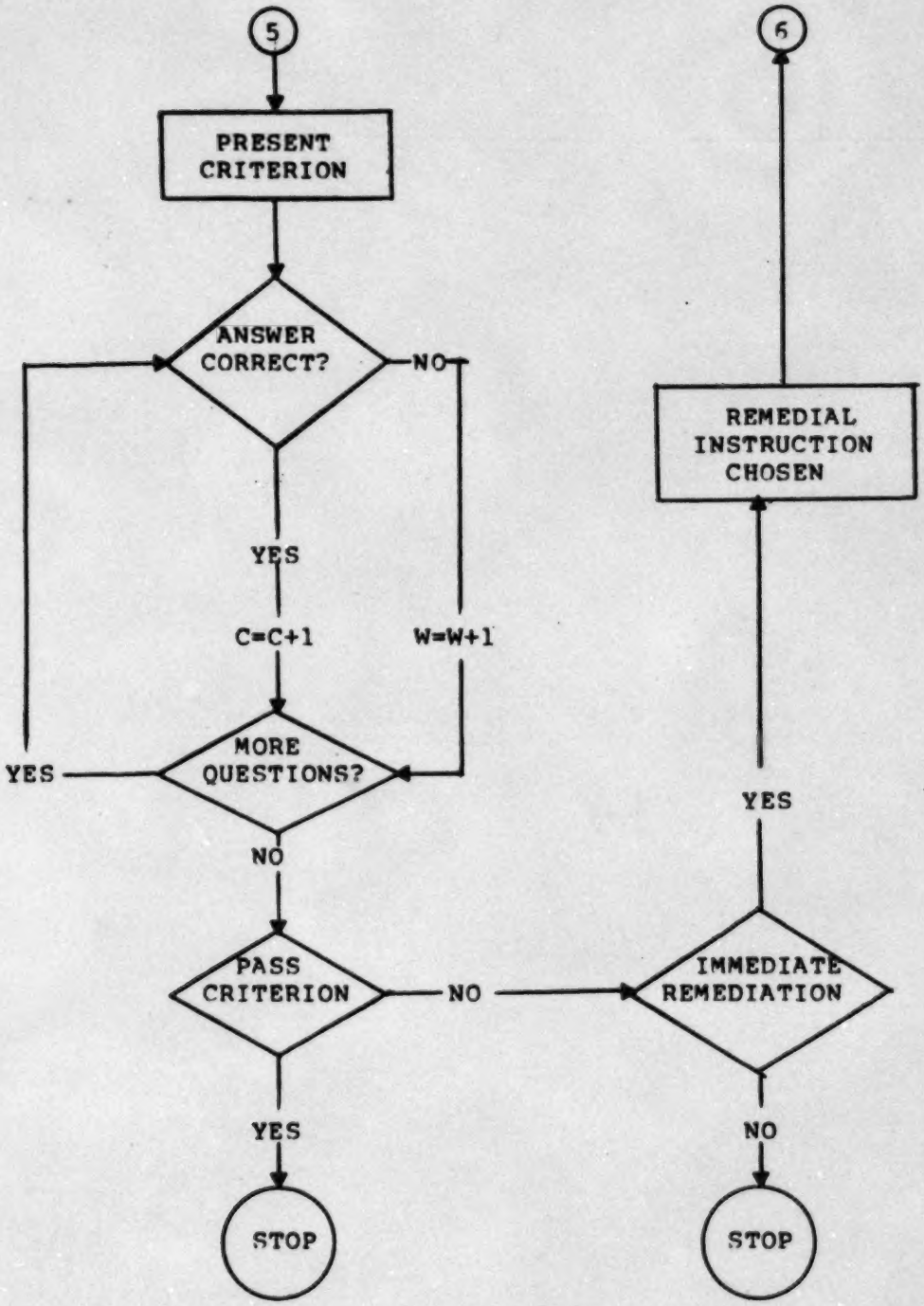

FIGURE 3
Criterion Presentation and Evaluation

Computer Simulations

Simulation is more likely to be effective in math or science classes than in English classes. In science classes, for instance, students can simulate the events of a particularly dangerous or expensive experiment. In both math and science, they can use simulation to predict long-range results of pollution or epidemic diseases. Nevertheless, simulation, in various non-computerized formats, long has been a technique used in English classes. Students often have simulated occupational or political situations for the sake of practicing the skills of argument or of persuasion (for instance, writing a letter of application to a fictitious employer, or a complaint about the streets to a non-existent alderman). Role-playing, often used in conjunction with the study of literature, is another form in which simulation has been used in English classes. Students, acting as characters from a novel or a story being studied, predict how that character might react in a situation not yet encountered in their reading.

Computer simulation is not teriibly different from these other types. It provides students the opportunity to experience situations not available in reality. ISEAC 8e of this series, Computer Simulation and Its Instructional Uses, presents a thorough explanation of the various applications of computer simulations. These instructional applications are categorized in three ways, based upon the learning goals possessed by each: (1) replicable performance simulations; (2) information retrieval simulations; and (3) encounter simulations. Of these three types, only the third seems applicable to English classes. The first, replicable performance simulations, have as their learning outcome replication of a specifiable performance. Such simulations involve mastery of tasks as might be necessary in driver's education, but which would not particularly apply to English classes. The second type, information retrieval simulations, have as their goal the securing of information. If students want to consider the impact of changing variables in a particular system--genetic reproduction, for instance, or ecological balance in a lake or a forest--this type of simulation allows them to do so and to understand the principles of cause and effect involved. Again, the applicability to English classes is remote (except, perhaps, as illustration of cause/effect relationships). The third type of simulation, though, the encounter simulation might well be put to use in English classes. In these, the learning goal is simply the experiencing of a situation, in order to assess the degree of variability among consequences. As suggested earlier, students might use simulations as an alternative to role-playing, putting fictional characters from their current literary studies into not-yet-known situations, so that a variety of plot outcomes could be considered and discussed.

No example of simulation programming written specifically for English instruction is available. About these encounter simulations, in fact, the situation is a bit bleak. Dennis, in the same publication from this series cited above, states:

> Obviously this [encounter simulation] is the type of simulation we know least about. It is not unlike the problem solving category found in various taxonomies of cognitive behavior. Relative to any one phenomenon se-

> lected, we generally can identify very good or very bad interactions or performances with that phenomenon. However, the principles, ingredients, and systematization of such behaviors are missing (ISEAC 8e, p. 5).

Nevertheless, this is not to say that the investigation of the applicability of simulations to English classes should be discontinued. Before reaching any final decision, teachers/programmers should consider the following questions: What, if any, new learning is produced by the activity? Is it possible that students with a particular learning style learn better from simulations than from other, more systematic presentations? Is it possible that certain students might learn more from building a simulation for other students to use than from taking tests or completing other projects? If a teacher can conceive of an affirmative answer to any of these questions, then teachers/programmers should consider the possiblity of writing one or more simulations for use in English classes. (Once again Computer Simulation and Its Instructional Uses--ISEAC 8e of this series--will provide relevant reading. See pages 14-24 of that document.)

Summary

This section has described two types of computer programs--tutorial programs and simulations. Though the latter have not yet found much application in English classes, the former are very promising. Several selections from such programs were presented, along with comments about the need to develop even more sophisticated tutorial instruction in the future.

Projects:

I. For Everyone

1. Go through a tutorial program as if you were a student, deliberately offering a few wrong answers. Does the program evaluate your responses and channel you to appropriate instruction or review? Look at a listing of the program to determine how it branches.

2. Examine a simulation--preferably of the "encounter" type. What are the learning outcomes derived--both intended and incidental?

II. For Teachers With Little Programming Experience

1. Develop a lesson plan in which use of a tutorial program is incorporated. What activities would you use to prepare students for the use of the program? Describe the program itself--its goals and activities. What follow-up activities would you use?

2. Repeat activity 1 above, but for the use of a simulation.

III. For Experienced Programmers

1. Develop a tutorial program for use in an English class, or improve upon an existing program to increase its level of sophistication in evaluating and responding to students' input.

2. Using the program you examined for project #2 (above), can you describe (or preferably, create) a similar program with content applicable to an English class?

Suggested readings:

Atkinson, Francis D. "Designing Simulation 'Gaming Activities' A Systems Approach." Educational Technology, XVII (February, 1977), 38-43. The author encourages instructors to design simulations as an effective teaching methodology (not necessarily computer assisted).

Blaiwes, Arthur S. and Dennis R. Weller. "A Social Simulator: Development and Evaluation." Educational Technology, 17, n. 3 (March, 1977), 14-20. The authors discuss use of simulation to train naval company commanders as leaders. Results were mixed--they concluded further research is necessary. But the article sheds light on the state of simulation development.

Braun, Ludwig. Learning Through Computer Simulations. (Available through the ERIC system: ED 104 3R/7.) Though directed toward science applications, some of this information is applicable to all teachers (regarding what is necessary for a simulation to be effective).

Dennis, J. Richard. Computer Simulation And Its Uses. (8e in this series.)

_____. Tutorial Instruction On A Computer. (6e in this series.)

Lunetta, Vincent N. "Human Transactions and Classroom Management: A Computer Based Unit in Teacher Education." Educational Technology XVII, 4 (April, 1977). He describes using simulations to allow users to explore the effects of various teaching strategies and styles on interpersonal incidents in teaching. (See also Owen Gaede's "Tenure" program on PLATO.)

Nold, Ellen. "Fear and Trembling--The Humanist Approaches the Computer." College Composition and Communication, XXVI, 3 (October, 1975), 269-273. An excellent introduction to the applicability of the computer in English classes. Includes samples of several tutorial types of programs.

V. Text Editors And Computer Programs To Evaluate Writing

As English teachers have long known, one of the most important ways in which students improve their writing ability is through revision. Unfortunately, the task of revising often is resisted by students, whose cries of "Do I have to rewrite the whole thing?" have echoed through classrooms for years. Text editors, a particular type of computer program, make that task of revising considerably easier--to the delight of students and teachers alike. Already in use by many newspapers and magazines, these programs allow authors to revise textual material without recopying unchanged passages.

Such programs, like all the programs discussed in this document, are intended for interactive use. That is, students should have access to either a video terminal (CRT) or a printing terminal while using the program (as opposed to a "batch" system, in which students turn in marked or punched cards, and get the results of their efforts at some later time). The program includes commands for such tasks as indenting, justifying margins, "erasing" single words or whole lines, capitalizing, etc. The student/author simply types in the appropriate commands and then types his composition. The computer prints the finished product with the margins, new paragraphs, capitalization, and punctuation called for. The teacher can read the resulting composition either by viewing it on a CRT or by having a paper copy of it and can make note of suggested editorial changes. Once the student receives the teacher's comments, he can easily make the corrections indicated--whether the change is one letter, one word, or several lines--without recopying those parts of the composition which are satisfactory. The advantage in this situation is twofold: the task of mere copying is eliminated, as is the risk of introducing <u>new</u> errors due to careless copying.

As an example of text editing, the following pages include a partial listing and a passage which was created and edited using a text editing program. (Do you recognize the passage?)

```
00100 .NONMP
00200 .I 60 ^NUMBER 1E .B 4
00300 .C ^THE ^ILLINOIS ^SERIES ON ^EDUCATIONAL ^APPLICATION OF ^COMPUTERS
00400 .B 10 .C <TEACHER <EDUCATION <IN
00500 .B .C <USE <OF <COMPUTERS
00600 .B 5 .C ^J. .X ^RICHARD ^DENNIS .B 10
00700 .C ^COLLEGE OF ^EDUCATION
00800 .C ^DEPARTMENT OF ^SECONDARY ^EDUCATION
00900 .C ^UNIVERSITY OF ^ILLINOIS
01000 .C ^URBANA, ^ILLINOIS
01100 .B 2
01200 .C ^THIS WORK WAS SUPPORTED BY A GRANT FROM
01300 .C ^THE <EXXON ^EDUCATION ^FOUNDATION
01400 .B .C ^COPYRIGHT, 1979, ^DEPARTMENT OF ^SECONDARY ^EDUCATION
01500 .C ^UNIVERSITY OF ^ILLINOIS
01600 .PAGE
01700 .LM 5 .RM 70 .P 10 1 5
01800 ^TO THE READER, .B
01900 .PP ^THIS IS ONE OF A SERIES OF DOCUMENTS PREPARED AS RESOURCES
02000 FOR THE PRESERVICE AND INSERVICE TRAINING OF TEACHERS.  ^THE
02100 GENERAL THEME OF ALL ITEMS IN THIS SERIES IS "TEACHING .U WITH .NOU
02200 OR .U ABOUT .NOU COMPUTERS".  ^THE BOOKLETS ARE THE COLLECTIVE
02300 WORK OF A VARIETY OF STAFF AND STUDENTS (BOTH PRESENT AND FORMER)
02400 OF THE ^COLLEGE OF ^EDUCATION, ^UNIVERSITY OF ^ILLINOIS AT
02500 ^URBANA-^CHAMPAIGN.  ^THE PROJECT GENEROUSLY WAS SUPPORTED
02600 BETWEEN 1977 AND 1979 BY A GRANT FROM THE <EXXON ^EDUCATION
02700 ^FOUNDATION.  ^ALL RESPOSIBILITY FOR THE CONTENT OF THESE
02800 DOCUMENTS RESTS WITH THE AUTHORS AND DOES NOT REFLECT NECESSARILY
02900 THE VIEWS OF THE <EXXON ^FOUNDATION.  ^IT WAS MY EXTREME
03000 PLEASURE TO DIRECT THIS EFFORT THROUGHOUT.
03100 .B 3 .I 40 ^J. .X ^RICHARD ^DENNIS, ^PH^D
03200 .I 35 ^DEPARTMENT OF ^SECONDARY ^EDUCATION
03300 .I 40 ^UNIVERSITY OF ^ILLINOIS
03400 .PAGE
??
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If the computer can make the composing process easier for students, can it make the grading process easier for teachers? That seems a fair enough question, and one which has been the focus of several researchers. The answer is a qualified "yes" at this point. Programs exist to allow various quantitative and qualitative evaluations of writing--but whether or not teachers are willing to use the criteria of such programs as the basis for grading student papers is doubtful.

Henry Slotnick is one researcher in this field. His doctoral dissertation at the University of Illinois in 1971, entitled, An Examination of the Computer Grading of Essays, dealt with use of the computer to improve interrater reliability in grading. Having observed the grading patterns of several experienced composition instructors, he noted that certain aspects of what was judged to be good writing involved patterns which could be recognized by the computer (in words, sentences, and paragraphs). He wrote a computer program which recognized those patterns, and found his program had high reliability and validity for predicting the grades assigned by the instructors.

In a journal entitled Computers and the Humanities, articles regularly appear which involve computer analysis of various literary works. Studies may count the number of polysyllabic words in a short story, for instance, or tabulate the variety of sentence structures. Such studies are particularly apt for linguists, who are paying attention to the structure and forms of natural language. They also help dialect specialists to identify and analyze differences among various dialects.

Might classroom teachers find programs such as these helpful in evaluating student-written compositions? The answer obviously depends upon what criteria the teacher is stressing. Numerous studies of the evaluation practices of English teachers have shown, time and again, that a single essay presented to several teachers will receive several grades, ranging from A to F. So, if a program written to tabulate totals of complex sentences and multi-syllabic words is used by a teacher whose emphasis is on developing the student's "authentic voice," the results will be disastrous. On the other hand, if the teacher is aware that what the program measures is identical to what s/he measures, then the possibility exists not only of saving the teacher's reading time but also of increasing the objectivity with which papers are graded. As noted about Slotnick's study, the success he had was in predicting the grade a particular teacher would give a particular paper--because the computer had imitated that teacher's grading process. This does not mean that a single computer program can grade all the papers assigned by several teachers and satisfy every teacher. One program might, however, replicate a given teacher's grading habits, and might eliminate grading inconsistencies which sometimes arise due to hurried readings, preconceptions ("Johnny always writes well"), or any of several variables which affect the teacher (time of day, location of the paper near the top or the bottom of a stack of papers to be read, etc.).

Professor Rosemary Hake of Chicago State University has directed a study which used computers in the evaluation process in a slightly different way. Papers were graded by teachers, not by computers. However, each error which a teacher noted was coded in one of four categories, and a tally was made by

the computer of the number and types of errors in each paper. Comparisons could then be made in a couple of ways. A particular paper could be measured in relation to that teacher's usual grading procedure. (That is, based on Mr. X's past grading of papers, this paper is likely to receive a passing or a failing grade.) Or, the teacher's grading system could be compared to the systems used by other teachers in the department. (Mr. X is likely to grade this a passing paper, though most teachers in our department would not.) The latter capability is handy to have if departmental testing is required before students receive credit in a course. With it, the grading system of any individual teacher can be adjusted statistically to a departmental norm, so that when departmental tests are given, not every paper need be read by two graders to determine "pass" or "fail." Thus, if both Mr. X's grade and the "adjusted" grade indicate passing, the student passes. If both indicate failure, the student fails. Only in the instances of discrepancy between Mr. X's grade and the adjusted grade need there be a second reader.

Summary

This section has dealt with two of the most interesting, and perhaps the most controversial, applications of computers in the teaching of English. The use of computer programs to simplify the task of editing has already become widely accepted and implemented in journalism but remains of limited use in English classrooms because of the need for hardware accessible to as many as twenty to twenty-five students per class. Application of computer programs for the evaluation of students' writing, on the other hand, is limited not because of needed hardware but because of problems in developing software acceptable to teachers.

Projects:

1. If your local newspaper or television journalists use a computer in their editing of stories, try to arrange a visit and demonstration of the technique.

2. If you have access to a text-editing program, use it to compose a brief report on the advantages/disadvantages of CAI in the teaching of composition.

3. (A team effort--for an experienced teacher working with an experienced programmer.) Using a set of papers graded by one teacher, try to identify criteria which could be replicated in a computer program.

Suggested readings:

Bishop, Robert, and others. Adapting Computer-Assisted Instruction to the Non-Programmer. Available through the ERIC system: ED 081 231.

Computers and the Humanities. A journal.

Cooper, Charles R. and Lee Odell. Evaluating Writing: Describing, Measuring, Judging. Urbana, IL: National Council of Teachers of English, 1977. Though not primarily about the use of computers, the book does include some treatment of the ways in which the computer can be used in evaluation of students' papers.

Hake, Rosemary. "With No Apology: Teaching to the Test." Basic Writing I (Spring/Summer, 1978), 39-62. This article not only explains the way in which papers were graded, but also includes samples of students' papers.

Levy, Lynn B. and Kentner V. Fritz. Status Report on the Computer Grading of Essays. Madison, Wisconsin: University of Wisconsin, 1972. Includes reviews of articles dealing with computer grading of compositions.

Riskin, John. Written Composition and the Computer. Urbana, Illinois: University of Illinois, 1971. He describes what is possible for teaching composition with CAI. Deals with such concepts as audience, purpose, thesis, organization, etc.

Slotnick, Henry B. An Examination of the Computer Grading of Essays. Ph.D. dissertation, University of Illinois, 1971. He wrote a program which could recognize certain patterns, then predict the evaluations of instructors.

Su, Stanley Y. and Robert L. Moore. Discourse Synthesis, Analysis and Their Application to CAI (Computer-Assisted-Instruction). Gainesville, Florida: University of Florida, 1972. The computer was used to synthesize and analyze news stories at the paragraph level, and to provide evaluative remarks to journalism students.

Zoller, Peter T. Composition and the Computer. (Available through the ERIC system: ED 127 611.) Really describes teaching grammer, not composition, for remedial composition students. Too many variables involved to allow any valid conclusions, but students' attitudes were positively affected.

VI. Computer-Assisted Test Construction And Computer-Managed Instruction In English Classes

Earlier, this work presented the idea that teaching about computers should be a part of English classes, whether or not English is taught with a computer. Sections II through V offered instances of teaching with computers and pointed out that most programming relevant to English classes requires interaction (dialog) between student and computer. As this section will point out, though, even when equipment limitations or teachers' hesitations prohibit interactive uses of computers, there are other ways in which accessibility to a computer can benefit both teachers and students. The preceding discussion of computer-assisted evaluation of essays provided one instance of such non-instructional applications of computer. Two other indirect uses of computers are presented here: computer-assisted test construction (CATC) and computer managed instruction (CMI).

Computer-Assisted Test Construction

As its name indicates, CATC provides help for the teacher in constructing tests--by storing, generating, categorizing, or evaluating test items (or doing any combination thereof). A general explanation of such applications appear in ISEAC 12e of this series, A Look At Computer-Assisted Test Construction by Viktors J. Muiznieks and J. Richard Dennis. Those authors point out the following advantages of CATC: provision of question banks (with accurate specification of items), ease of test printing and scoring, provision of item analysis and diagnostic feedback for both teachers and students. They also note that:

> Computerized test preparation systems are potential components of more sophisticated computer-managed instruction approaches. These more extensive systems can include instructional decision-making elements, such as diagnosis of learner difficulties and prescription of individual assignments. CATC systems also can be integrated into individualized instruction programs which assist students in proceeding through large units of instructional materials more independently, without the need for continuous contact with instructional staff (p. 4).

Most important, the computer used in this way relieves teachers of many time-consuming clerical tasks, freeing them to concentrate on instruction and the learning process. (Those who have not yet read ISEAC 12e would be well-advised to do so before attempting the projects suggested at the end of this chapter.)

All of the examples cited in the Muiznieks and Dennis work, however, are drawn from mathematics and science. This is not due to any narrow-mindedness on the part of the authors, to be sure, but simply to the fact that those subjects involve objectives which better lend themselves to objective testing. Nevertheless, while English classes are not the place for computations, they still can be served by CATC. After all, the intention of all testing is to

provide feedback to both teachers and students. But because of class sizes and heavy teaching loads, few teachers have the time to formulate alternate versions of tests, or to do thorough statistical analyses of test results. Through the assistance of the computer, these formerly time-consuming tasks become easy to do.

One advantage is the banking of test items. An individual teacher working over a period of time, or a group of teachers from one department working together, can develop a variety of test questions, pooling a set for each course. These questions can then be described in various ways (level of difficulty, material covered, format), so that--at test time--each teacher can specify certain traits for a made-to-order examination (e.g., "ten multiple choice questions about The Red Badge of Courage: three easy, five moderate, and two difficult"). Depending upon the size of the question pool developed, teachers can make alternate versions of tests to reduce the likelihood of one student's copying answers from another.

If teachers wish to administer the tests with paper and pencil, rather than via computer, the computer can easily print the questions on a duplicating master. And once the tests have been taken, the computer not only reduces the time needed for grading; it also provides statistical information about which questions were missed most often, which wrong answers were chosen with what degree of regularity, etc. Because the testing process becomes easier, the tendency is for teachers to test more frequently, thus providing more feedback to both themselves and their students about each student's progress (Muiznieks, 1978).

The question for us, suggested earlier, is: How valuable is CATC in an English class? As the old joke begins, "there is both good news and bad news" in response to that question. The bad news is that evaluation of essay questions--while a popular focus of research (see previous section)--remains beyond easy implementation by a computer. This limits the value of CATC in English classes, because essay questions are so often the preferred method of measuring students' mastery of the material studied, particularly for literature and invariably for composition. On the other hand, the good news is that CATC can still provide limited usefulness for essay questions (generating, categorizing, storing--if not evaluating) and thorough assistance in the development, administration, and evaluation of objective style tests. The following discussion treats, in turn, language, literature, and composition. Within each area, the applicability of objective tests (multiple choice, short answer, matching) is considered, as is the extent to which CATC can deal with essay questions.

Language

Several options for objective testing in language have been cited in earlier parts of this paper. To evaluate students' knowledge of vocabulary, for instance either multiple choice or matching tests would be suitable. The tests could involve any of several approaches: words and their definitions, words and synonyms, words and their antonyms, or combinations of root words and affixes. In relation to grammatical studies, short-answer tests might require students to identify subjects and verbs in given sentences, or to combine two given sentences into a compound or a complex sentence.

These kinds of tests are not at all new. They are essentially identical to those in any of several language arts texts or in standardized tests available today. Neither is it innovative to say that the tests can be used for diagnosis and placement, as well as measurement of mastery. The advantage of CATC, as noted, lies not in the kinds of tests available nor in purposes served by those tests; it lies, rather, in the ease with which a variety of tests can be constructed, graded, and statistically analyzed. For instance, if a large pool of root words and affixes has been formed and labelled in the computer during a "brainstorming" session at a department meeting, any teacher in the department can then formulate a matching type test generated by the computer. The teacher would simply program a request for three lists: five prefixes, five suffixes, and ten root words from the Greek and Latin languages. Test directions might require students to formulate and define at least fifteen words, using the three lists. If the teachers at the meeting had been active enough to try to come up with all legitimate combinations and store them in the computer, too, then this teacher could also turn the grading process over to the computer.

Another example of CATC involves objective tests in grammer. One of the most tedious tasks teachers face while teaching grammar is that of generating sentences which students use of diagramming, combining, or checking agreement (subject-verb, pronoun-antecedent, etc.). Using a template such as the one described in ISEAC 12e for mathematics and science problems, teachers could generate a countless variety of sentences simply by calling up computerized lists (singular subjects and singular verbs, compound subjects and plural verbs, prepositional phrases, etc.) to randomly fill the slots of a given sentence type.

These instances simply skim the surface of what might be done with objective tests in the teaching of language. Any teacher, or group of teachers, could easily develop more challenging and/or creative examples of CATC.

Essay questions, as noted earlier, are not completely within the province of CATC. Still, there is a partial role CATC can play. Essay questions involving language study might deal with tracing the etymology of a particular word, or with contrasting the phonological and morphological systems in two dialects. The computer might not be able to evaluate answers to such questions (apart from seeking key words or phrases), but it can still provide the services of storing and sorting questions, or of partially analyzing test results.

Literature

Test questions relevant to a study of literature might deal with aspects of a particular work studied (plot, character, setting) or with the relationship of that work to external factors (the history of the period in which it was written, traits that relate it to other works of its genre). Once again, the "template" system described in ISEAC 12e could be appropriate. Questions could be formulated in such a way that the titles of particular works or the names of characters/places/actions within those works are variables in the question statement. Then a teacher could call upon the same ten or twenty

question forms over and over again, simply substituting the variables appropriate to the work being studied. These would be ideal as "study guide" questions. Or, for testing, theycould be either essay or multiple choice questions. For example, an essay question format might be: "Compare and/or contrast the roles x and y play during z." Variables x and y might be the protagonist and the antagonist in the work studied, while z is the climax, or turning point, of the work. Or x and y might be the protagonists from two different works studied; and z, a specified aspect of plot development. (Again--because these are essay questions, the computer is not likely to be of help in asnwer evaluations.) A multiple choice question format might be, "Which of these events was the climax of x?" Or "Which of these events did NOT happen in x?" A matching type of question format might simply require students to number given episodes from a work in the order in which they occurred in the story, or to match a particular character with an appropriate action or quotation. Even if the "template" approach is not used, the concept of pooling a variety of questions which the computer can retrieve at test time, or when study guides are needed, is one likely to save several hours of teachers' time.

Composition

Composition is the facet of English instruction least likely to involve objective testing. As has often been stated, the only way to evaluate a student's writing ability is by having him write. Nevertheless, the computer can be of assistance when tests of students' ability in composition are required, whether via essay exams or objective tests. Essay questions themselves can be stored and randomly selected, or can be formulated through the "template" system explained earlier in this section. Essay answers can be partially evaluated, if a teacher so chooses, through such means as word counts, measures of sentence complexity, or searches for use of key words. And even if the essay answers are graded entirely by the teacher--without computer assistance--the computer can provide statistical analyses which might help the teacher ro interpret students' performance records. (Is there a relationship between length of papers and grades, for instance? If so, what is the relationship?) Also, on those occasions when objective tests can be used to measure students' ability in composition, CATC can be more helpful. Students' editing skills, for instance, can be measured with multiple choice tests which require students to identify and/or to correct errors in given passages. Such passages might be randomly generated if an appropriate pool has been developed (e.g., the teacher calls for "ten sentences with dangling modifiers, randomly intermingled with three fragments and two run-ons"). Or a matching type of test might require students to correctly pair brief passages with an audience for whom the passage would be appropriate. For such objective tests, the computer not only can provide test items, but also can score tests and yield statistical analyses of scoring patterns (frequency of wrong answers chosen, items repeatedly missed, etc.).

Computer Managed Instruction

The seond major focus of this section, computer managed instruction (CMI), refers to the use of a computer to handle the clerical and managerial tasks

which are so much a part of a teacher's duties. Certain of these clerical functions have already been identified in the discussion of CATC; that is, collection and manipulation of data regarding students' test performance. Other functions are the logical sequels of such data collection; they act on the basis of information gained. Based on the results of diagnostic testing, for instance, a well designed instructional management system can assign appropriate activities for a student to undertake (additional review of material, new reading in the text, consultation with the teacher, participation in a computerized drill, etc.). It can provide practice questions for the student, which offer him immediate feedback about the accuracy of his responses, but which are not graded--hence, relieving the student of the pressures associated with evaluation. The management system would, however, maintain records of students' performance in these practice sessions, so as to be able to renew the cycle of analyzing performance, assigning activities, etc. In addition, a CMI system can provide a variety of ways of reporting data on student progress: individualized accounts for each student, class and individual data for the teacher, and perhaps group statistics of various sorts for administrators, funding agencies, and the like.

A more thorough account of CMI systems is presented in ISEAC 11e of this series, Computer Managed Instruction and Individualization by J. Richard Dennis. Also in that document, the author describes the value of a CMI system for resource management: keeping track of equipment as well as of students. For instance, it has been noted repeatedly in this monograph that programs applicable to English instruction require, for the most part, interactive facilities; each student must have access to a computer terminal in order to participate in the programs described. It has also been noted that few schools can be expected to have sufficient terminals for an entire class of twenty or twenty-five students to simultaneously engage in computer-assisted instruction. A CMI system could handle the scheduling of students so that a teacher could easily subdivide a class into several groups: perhaps one group working with the teacher, one with the computer, others with the text or with teachers' aides. The system would not only help the teacher keep track of the students, it could also help manage each student's time--offering alternative assignments, for instance, in the case of an unavailable resource.

The alert reader is, at this time, probably saying, "Fine, Jaycox. You tell me all the great things this CMI system can do, but you don't tell me how to do it. How do I get all the information INTO the computer, so that the management program is able to make all these elaborate decisions?" A valid question, indeed. And the answer is not easy. Parts of such a system, of course, are aspects of computerprogarmming already presented in earlier sections of this work and in other work in this series (topics such as drill and practice, question episodes, test construction and evaluation). The decision-making capabilities of a CMI system require thorough input from the teacher--or perhaps from a group of teachers working together. ISEAC 11e, referred to earlier, lists a series of questions which require detailed answers, but which will allow the system to be "taught" what it needs to know. That list, illustrative but not exhaustive, is reprinted here. Many of the questions must be answered by providing detailed descriptions or sets of specific question episodes to the computer system.

1. What are the instructional objectives?
2. What are the prerequisite of each objective?
3. How will mastery of an objective be determined?
4. What type of curricular flow will be used (student section, find sequence, or adapted by individual performance)?
5. Where are remedial or help resources likely to be needed?
6. What remedial or help resources are available at each point?
7. What action to take when no more remedial or help resources are available?
8. What information about performance is to be gathered?
9. How is information to be processed and reported?
10. What pacing procedures are to be used and in what conditions?
11. What type(s) or testing is (are) to be used and how often?
12. What are the criteria for testing success?
13. What resources will be used in study?
14. What resource scheduling will be needed?
15. What are the constraints on loading of the resources?
16. If grades are used, how and when are they to be assigned?

ISEAC 11e also offers several cautions about the use of CMI systems, ranging from the suggestion to "start simply" to the warning that students, as well as teachers, will require some introduction to the concept of individualized instruction and its consequent impact on the roles of both students and teachers. A review of ISEAC 11e, and particularly of pages 18-21 within it, would be appropriate.

Lest the reader be too discouraged about the complexity of CMI systems, note that several such systems already have been created and are available for implementation and/or adaptation. Some of these (PLAN, TIPS, CISS, AIS,

TICCIT) are described in the final pages of ISEAC 11e. Another, CAISP, developed for micro-computers by several associates of the Department of Secondary Education at the University of Illinois, is thoroughly explained and documented in ISEAC 23. Using CAISP, a teacher can simply introduce appropriate text, questions, and assignments to a pre-packaged control and management system.

Conclusion

This section has presented a discussion of two educational applications of computers which, while not directly instructional, are instructionally related. Both are intended to relieve teachers of clerical functions, freeing them for more time in direct contact with students. Computer-assisted test construction (CATC) can involve formulation, administration, and evaluation of tests. Though it is better adapted to dealing with objective tests than with essay exams, it still has many potential applications in English classes. Computer managed instruction (CMI) can keep track of and direct students' progress, as well as help the teacher in efficient management of time and resources. Though only a fraction of its potential has been realized in systems written to date, some of the systems available (such as CAISP) can allow even teachers with little or no understanding of computers to take advantage of their capabilities.

Projects:

I. For Everyone

1. Divide the class into three groups: one ach for language, literature, and composition. Each group should compose a list of twenty or thirty objective questions applicable to its subject matter. Try to have at least a few multiple choice and matching, as well as short answer.

2. Duplicate the lists from project one for the class to share. Might some of the multiple choice questions be better presented as items in a matching test? Might some of the matching items be better as multiple choice or short answer? Why or why not?

3. Chose any ten questions from the total group. Acting as if the questions were going to be "pooled" in a CATC system, list as many attributes as possible for the ways you would categorize each question (type: multiple choice, matching, etc.; level of difficulty; subject matter).

4. In the same three groups formed for completing project one, formulate as many "templates" as you can for use in tests or exercises of as study guides for English classes.

5. (Again in those three groups) Formulate ten essay questions for your subject. As you did in project three, identify as many labels as possible by which such questions could be indexed.

6. Discuss the possible uses to which a teacher might put the statistical breakdowns of test results. How might an administrator, or the department as a whole, use such results? Both good and bad interpretations are possible; what cautions are necessary for teachers and administrators?

II. For Teachers With Little Programming Experience

Try to obtain access to CAISP or to a similar CMI system. Use it with actual texts and questions from a course in your field. Then ask a student (or a willing fellow teacher) to implement it. Discuss the results. What's good? Bad? What would you change? Why? How?

III. For Experienced Programmers

Begin a flowchart to describe the programming necessary to accomplish some of the information processing described in the list of sixteen questions on page nine.

Suggested Readings:

Dennis, J. Richard. Computer Managed Instruction and Individualization. (11e in this series.) Dennis offers a rationale for, and a description of, the functions of a CMI system. Bibliography.

Handler, Kenneth. "The Computer Comes to the English Classroom: Computerized Monitoring of Pupil Progress in Reading." Educational Technology (November, 1975), pp. 34-35. He describes a system (NOT instructional) which provides diagnostic tests, evaluation, and prescription for instruction. This was used with junior high school English classes, but could be applicable in high schools, too.

Individualized Reading Instruction for Students' Computer-Managed Reading System. (Available through the ERIC system: ED 127 552.) This report from a Louisiana school board explains their project. It deals with CMI.

Limpus, John, et. al. Documentation--CAISP: A Small Computer CMI System. (23e in this Series.) August, 1979.

Michael, Gary and Mary Sliger. Language Arts Routing System (LARS) Instructor's Manual. Urbana, Illinois: University of Illinois, 1976. LARS is a CMI system implemented on PLATO. This manual explains how the system may be used alone or in conjunction with classroom instruction.

Millman, Jason. Creating Domain-Referenced Tests By Computer. (Available through the ERIC system: ED 135 852). He has developed a "template" system, storing not items, but item algorithms. He discusses use of it in his college course, taught by a "mastery" strategy.

Muiznieks, Viktors J. and J. Richard Dennis. A Look At Computer-Assisted Test Construction. (ISEAC 12e.) This is a very thorough treatment of the reasons for testing, goals of testing, description of test types, and explanation of the capabilities and limitations of CATC. Bibliography.

VII. Building In Feedback In English Classes

Whatever the role a computer might play in a classroom, it is obvious that teachers need a way of evaluating its effectiveness. The discussions earlier identified the importance of providing feedback to the student within every instructional activity. As he executes each one, the student repeatedly needs some response to let him know whether he is progressing toward that activities' goal or veering away from it. These responses range from simple remarks ("Great! You really know your stuff!" or "Ooops! Care to try again?") to elaborate branching patterns which take the student through needed reviews. Similarly, feedback is needed on a broader scale as both students and teachers evaluate progres toward course goals and the computer's effectiveness as an aid to reaching them. Such evaluation may take several forms: preliminary screening of commercially prepared courseware or software, students' evaluative comments based on their interactions with specific programs, and teachers' evaluations of the effectivess of programs and of the overall contribution of the computer to the classroom.

Evaluation Of Courseware And Software

The first type of evaluation, that of courseware (instructional programs complete in themselves) and software (instructional program formats, such as CAISP), is the subject of ISEAC 5e in this series, Evaluating Materials For Teaching With A Computer. In that paper is a series of questions for the teacher to ask about commerically prepared materials. Included here is an excerpt from these guidelines.

> For courseware reviews the following are useful. Generally, this list applies whether the courseware constitutes a single lesson or a set of several lessons:
>
> 1. Material Information
>
>   a. Description of material and objectives
>   b. Curriculum plan within and around lesson
>   c. Flowchart of individualizing paths within courseware
>   d. Copies of references to ancillary material
>   e. Program listings and related documentation
>
> 2. Student Information
>
>   a. Audience descriptions
>   b. Expected entering behaviors
>   c. Means of "shadowing" typical students through material
>   d. Expected terminal behaviors

For evaluation of instructional software, teachers should raise these questions (ISEAC 5e):

1. What instructional tasks are to be performed by a computer?
2. What is the context in which these tasks take place?
3. What is the expertise of the intended users?
4. How well does the package fit existing equipment?

Once you have determined what a particular software package should do, and have identified one or more sources of such a program, you are then in a position to make an evaluation. For software, some of the most important questions to ask are:

1. How well does the package match the task defined?
2. How easy is the package to modify?
3. How much does the package cost?
4. How well is the package documented?
5. Where can the package be seen in operation?

The balance among the answers to these questions is very important to consider. A software package apparently providing the services desired, but either poorly documented or not available in a form that is modifiable (i.e., no source program available) will be both very difficult to learn to use and almost impossible to alter in the future. If being purchased from a vendor who offers adaptation of the program at little cost and readily available assistance with implementation and personnel training then the quality of the documentation perhaps can be overlooked.

An appendix of ISEAC 5e includes a ten-page "Courseware Evaluation Worksheet." This worksheet can provide invaluable assistance to the teacher seeking to judge the effectiveness of particular programs. Questions are raised not only about the courseware itself, but also about observed executions of the programs by students.

Aspects of programming particularly significant for English teachers to note would be the judging ability and the branching ability of courseware. The former could be important, for instance, regarding the spelling of words. That is, if questions are asked which require short answers about literature, and if the program recognizes only the exact spellings of charcter and place names, then a student who is correctly identifying--but is mispelling--a name or names could easily become frustrated or misled. Secondly, attention to the branching ability of the program can give the teacher some sense of what will happen in response to a variety of student inputs. If a student gives

a wrong answer to a question about the concept "metaphor," for instance, what does the program do? Does it offer more questions, in an effort to identify his problem? (i.e., Is he confusing metaphor with another concept, such as simile or personification?) Or does it simply recycle him through explanatory text and/or examples? Similarly, if a program is intended to help students compose an essay, and if one of the opening questions of the program asks the student to identify the main purpose of the essay as description, narration, argument, or exposition, does the program branch to different sequences of questions appropriate to the identified purpose?

When implementing the evaluation procedure outlined on the worksheets of ISEAC 5e, teachers should keep in mind not only how a program is intended to function, but also how it is likely to function when unexpected input is offered by students (referred to as "focusing executions").

Evaluation Of Students' Interactions

This second aspect of evaluation can take two formats: direct and indirect. Direct evaluation includes both the observations of student executions of programs and evaluative questions "built into" the program. That is, it is relatively easy for any teacher/programmer to "chain" a given program or set of programs to an "all purpose" evaluation program. Then, as a student reaches the final stages of an instructional event, he would automatically be presented with some general questions about its effectiveness. (Which program have you just completed? Did you find it very easy, very hard, moderately easy, moderately hard? What did you like best? Least? How long did it take you to complete the program? Which, if any, questions confused you? What improvements/additions/deletions would you suggest? etc.)

Indirect evaluation could be accomplished through CMI systems (described previously). Such systems could keep track of which programs are used most and which, least. Which questions are usually answered correctly on the first attempt? Which questions are most frequently answered incorrectly? What is the average number of attempts required to correctly answer those questions? In multiple choice situations, with what frequency is each option chosen? What is the average length of time needed to complete each lesson? etc. Such indirect evaluation evaluation helps to provide a more balanced measurement, because it can account for details likely to be overlooked in either students' evaluative accounts or in teachers' random observations of student executions of programs.

Evaluation Of Overall Effectiveness

As noted above, it is important to evaluate programs in themselves and also in respect to the way students execute them. But a final and overriding question concerns the ultimate effectiveness of CAI in the classroom. Is it worthwhile--in terms of both time and money--for an English Department, or even a particular English class, to use the computer either directly or indirectly?

The ultimate decisions about overall effectiveness may rest with any of several individuals or groups: individual English teachers, English Departments voting collectively, department chairmen, or perhaps with school administrators. Wherever the responsibility lies, those who make the decisions should keep in mind the many issues raised throughout this paper and the other papers in this series. The questions are not simply those of equipment costs and maintenance costs; nor is there a simple equivalency between computer-assisted-instruction and textbook instruction (an equivalency often suggested by such remarks as, "This isn't anything new of different. Our texts have included these exercises for years and years.") Rather, there is a complexity of evaluative criteria which involves issues such as those noted in the opening remarks of this paper: individual attention provided to large numbers of students, reduction of teacher time spent on non-instructional tasks, provision of analytical data helpful to teachers' evaluations of students' progress. When answering the question, "Has the computer enhanced the opportunity for students to learn?", decision-makers must keep in mind all of these factors. Teachers who are "computer literate" will be important voices contributing to such discussions.

Summary

This section has stressed the need for evaluative feedback on a broader scale than simply within programs. Three types of evaluation were discussed: evaluation of courseware and software, evaluation of students' interactions with programs, and evaluation of the overall effectiveness of computer-assisted-instruction in English.

As computers become more easily available to schools in the future, the need will increase for teachers knowledgeable about programming and about using a computer in their subject. English teachers familiar with the various programs and program types described in this paper will be able to make more intelligent and informed judgments about the extent to which CAI is applicable in their classes.

Projects:

I. For Everyone

1. Using appropriate questions from the "Courseware Evaluation Worksheet" of ISEAC 5e, complete an evaluation of a piece of coursework potentially applicable to your classes.

2. In general (that is, not basedon any particular program), list three or four potential problems related to either judging ability or branching ability which could limit the usefulness of courseware. (Recall, for instance, the potential problems with mispelling.)

3. What are the advantages of evaluation based on direct observation of students' execution of programs? What are the disadvantages?

4. List as many information bits as you can (of the type discussed on p. 43) which could be gathered via indirect evaluation--for instance, using a CMI system. Be prepared to discuss what service, or possible disservice, might be accomplished as a result of collecting such data.

5. Imagine yourself as the English Department's spokesperson facing your local school board. The board is debating the value of investing more money for instructional computer facilities in your school. What will you say to them?

II. For Teachers Without Programming Experience

If you were writing the evaluation questions for a computer-administered evaluation program (such as the one suggested on p. 43), what would be some of the questions you would present to the student? Try to structure as many as possible in a multiple choice or a matching format, so that the answers can be "read" and stored by the computer for eventual analysis.

III. For Experienced Programmers

Work with an inexperienced programmer to implement the type of evaluation developed in the project above, and chain it to existing instructional programs which your students can execute.

Suggested Readings:

Antistia, John A. A Comparative Study of Computer-Assisted and Non-Computer-Assisted-Instruction in Senior High School English Classes. (Ed.D. dissertation, Wayne State University, 1974, available through the ERIC system: ED 110 983.) The finding was "no significant difference"; further research was recommended.

Costello, D. F. Computer Software In Education: Property Rights, Uses, Royalties. (Available through the ERIC system: ED 138 167.) In this paper presented at the Second Annual Academic Planning Conference at the University of Southern California, Costello reviewed the history of commercialization of software and noted developing opportunities in the production of courseware.

Dennis, J. Richard. Evaluating Materials For Teaching With A Computer. (ISEAC 5e.) Dennis presents lists of questions to ask, and the reasons for asking them, when evaluating courseware and instructional software.

Miller, LaVerne W. "The Humanist and Computer Assisted Instruction--or Until the Lightning Struck," Educational Technology, 12, n. 12 (December, 1972), pp. 52-58. After discussing her experience

in seeking to implement CAI in the English department at her institution, Ms. Miller notes several points future CAI users must consider. Most important is to remember that CAI is a MEANS, not an end. Teachers should consider what it can do for students, to help accomplish the goals of the course.